Adobe® and Digital Content for eCommerce

Adobe Acrobat® technology for customized secure transactions

Revolutions have been a long time coming in the publishing world. After Gutenberg, we waited more than 500 years for the advent of desktop publishing, with several notable but not necessarily transformational improvements in between. And while software such as Adobe PageMaker® helped publishers transfer the production of books from the movable-type press to the computer screen, the final, published product remained essentially the same: ink on paper, bound and distributed via land, sea, or air. For the next truly fundamental shift in publishing, we did not have to wait nearly as long—in just a few short years, the Internet has transformed the publishing industry in phenomenal ways. Online book selling has garnered the most attention from the press, and with good reason: in 1998 alone, 9 million people bought books online, eager to take advantage of the ultimate in availability and convenience.

However, today's publishing industry leaders are becoming equally intrigued by another compelling Internet-borne trend—the electronic commerce of digital content. Selling content directly to consumers over the Internet does more than just eliminate the physical costs of paper and printing material from the bottom line. It opens previously untapped distribution channels, allows for highly customizable (and profitable) customer solutions, and exposes new business models for forward-thinking publishers.

While catalyzing new business opportunities, this electronic delivery model also raises complex questions about the protection of digital rights. Publishers, distributors, and resellers have learned a lesson from watching the music industry struggle with the consequences of digital music distribution. Created to ensure the secure distribution of MP3 digital music files, the Secure Digital Music Initiative (SDMI) was established only after several industry missteps. Wary of making the same mistakes, print publishers and content owners will not fully embrace the electronic commerce of digital content until they can implement digital rights protection mechanisms that are fully customizable, industry-standardized, and appropriately secure. By combining Adobe Acrobat with Web Buy and Adobe PDF Merchant,Adobe Systems delivers the enabling technology to provide the security and the confidence needed to explore the robust possibilities of selling digital content over the Internet.

Laying the groundwork for online sales of digital documents

Three major forces are enabling the rapid adoption of digital document eCommerce: the growing availability of digital content, consumer demand for the benefits of digital content, and secure environments and infrastructures that enable eCommerce.

Content. First, the content must be available in a digital form. Due to the emergence of desktop publishing 15 years ago, an array of already-published content is available in Adobe PostScript® and Adobe Portable Document Format (PDF), providing a huge base of content from which to draw. In addition, the emergence of print-on-demand solutions means more and more retailers are digitizing content. Out-of-print books are being brought back to life through scanning and OCR mechanisms, and newer books—often already available in digital form—can be printed on an as-needed basis. Add to these the many electronic documents, legacy documents, and books in PostScript format that can easily be made available for eCommerce.

Digital content can include technical manuals with detailed illustrations or flowcharts, the latest novels and biographies, financial or business analyses, magazines, or even information published from an office application or captured from the Web. The format of choice for digital content, Adobe PDF offers an exact representation of the printed form, can be viewed across multiple platforms, is searchable, and has an installed base of more than 100 million Acrobat Reader users. Digital content libraries should rapidly grow as consumers embrace the technology and demand more titles.

Consumers. As digital content becomes more readily available, demand will continue to grow, expanding the electronic commerce chain. Users are slowly growing comfortable with consuming large pieces of information electronically and are beginning to realize the benefits. New handheld, dedicated reading devices display electronic documents for portable viewing of all kinds of information. Unfortunately, most of the content for these dedicated readers is currently tied to proprietary, hardware-based standards that prevent consumers from viewing these documents on more than one device. To achieve industry-wide acceptance of digital content for eCommerce, standards must be established and supported among publishers, distributors, retailers, and consumers. Additionally, users must be able to view their content on a variety of devices, from dedicated eBook readers to personal computers.

Commerce. Over the last three years, the Internet has become a widely accepted means for conducting commerce, supplying both the electronic bandwidth and infrastructure for monetary transactions. With bandwidth growing exponentially, distributing files over the Internet is not only an acceptable form of delivery, but is also far more convenient than many traditional forms of commerce.

For retailers and publishers to comfortably distribute content electronically, there must be a secure system in place that ensures content is protected from illegal distribution. The publishing industry wants to avoid the controversy surrounding MP3 files and the use of the Internet as a means for free distribution of music. It is challenged with finding an industry standard that protects ownership rights and delivers a consistent user experience across devices.

The digital content eCommerce chain

Because no one path can encapsulate the many ways digital content will eventually get to the consumer, Adobe allows individual players in the eCommerce chain to determine how they will deliver digital content and the associated commercial transaction. In one scenario, a publisher might produce Adobe PDF files, manage encryption keys, and fulfill the retail commerce transactions. In another scenario, the publisher might deliver Adobe PDF files to a retailer who locks the files, manages the keys, and fullfills the transactions. In some cases, the roles of the author, publisher, distributor, and retailer may be fulfilled under one roof. Regardless of the particular scenario, the steps taken through the eCommerce chain are consistent across the different paths.

A sample scenario. In order to visualize how the digital content eCommerce chain works, imagine this sample scenario. A customer is in immediate need of the information found in a specific reference book. She decides to visit her favorite online book retailer to purchase the digital version of the book. Before actually receiving her book, however, several things must occur. *(Note: The following is a conceptual view of the process rather than a technical description.)*

First, the author or publisher of the book may use an application such as Adobe FrameMaker,® Adobe PageMaker, QuarkXPress, or Microsoft Word to produce the book. If necessary, the images are optimized for online use before the document is converted to PDF.

The publisher then encrypts the PDF file using Adobe PDF Merchant software and generates the unique encryption key that unlocks the document, ensuring that only authorized users are able to view the document. The publisher can also include a unique URL pointing back to a Web site (of the publisher, an author, or a retailer) where the customer can purchase the permission to view the document.

Once she finds the book at the online book retailer's Web site, the customer clicks on the button to purchase the book. She is shown a dialog box requesting unique identifying information from her computer. Once she gives permission to the online retailer to access this information, the retailer automatically verifies the CPU ID, user ID (login name), and storage device ID. Some retailers may ask permission to store this information in a customer profile, thereby streamlining future transactions. Finally, the customer enters her credit card or other financial information (such as Web-based micropayments or wallets) to complete the purchase.

The encrypted PDF version of the book is automatically downloaded, along with a small software voucher uniquely locked to the customer's computing environment. With the help of a plug-in called Web Buy, the customer can view the electronic book using the free Acrobat Reader software. She can also search the full text of the book and navigate its contents quickly using links. Because it appears in Adobe PDF, the book even looks exactly like the printed version and contains all the original artwork, diagrams, and charts. The next time the document is opened, Web Buy automatically recognizes the voucher and displays the content.
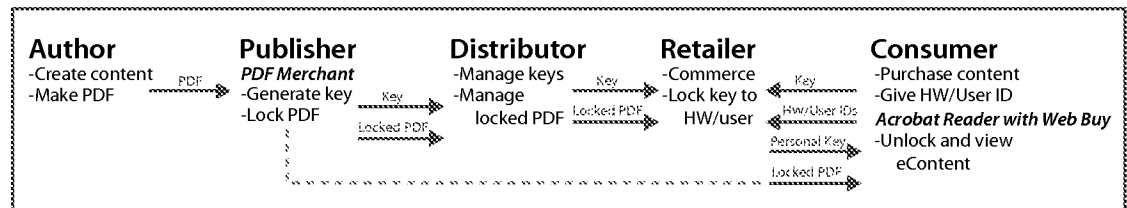
Adobe PDF Merchant and Acrobat Reader with Web Buy enable a general, extensible process for moving content from the author to the consumer.

Details and implications

While the workflow described above gives an overview of one possible scenario, there are many potential paths through the eCommerce chain, with implications for each of the individuals or organizations involved. Authors have many choices to make when creating their content. Publishers need to think about how documents will be distributed, as well as how to implement a secure environment for distribution. Retailers have concerns over distribution and security, as well as file management, customer service, and cost reduction. Finally, consumers have a variety of ways to receive and view documents. We will look at each of these players in more detail and identify the ways in which they are affected by the eCommerce of digital content.

Authors. Creating an Adobe PDF file from digital content is made easy with tools from Adobe and third-party vendors. If the existing content is available in PostScript (as are many archived printed materials), it can be directly converted into Adobe PDF. Adobe PDF files can also be directly generated from HTML files, documents created with Microsoft Office, or virtually any electronic file. Care should be taken to ensure that images and graphics are downsampled appropriately to achieve the best trade-off between visual fidelity and small file size. For example, an author might downsample graphics to 150 dpi, choose a medium level of JPEG compression for raster images, and embed all fonts to ensure the digital files are optimized for the user's environment.

In the Adobe PDF creation process, links and bookmarks from the Table of Contents, Index, and any cross-references can be automatically generated depending on the level of feature support of the authoring application. Many third-party add-on products for Acrobat software also add features. Once created, Adobe PDF files can be distributed digitally, exactly as intended.

Publishers. The most common distribution model for today's electronic document publishers is one of direct distribution, in which a document seller must prepare a unique copy of the document for each buyer. To help publishers get their content to the widest possible audience, a "super-distribution" model can also be used. In this model, content is distributed widely but can only be viewed with the use of a valid voucher. Documents containing this content are encrypted once and freely distributed. The vouchers for using the content are sold separately to each buyer and tied to that buyer's environment. For example, an author, publisher, or reseller could distribute a document across a corporation, track each person who requested permission to use it, and at the end of the month bill the company for the exact number of users who accessed the document.

As server-based software, Adobe PDF Merchant was designed for easy integration into existing eCommerce and transaction servers. Using PDF Merchant, publishers can easily encrypt volumes of Adobe PDF documents and link the files directly to a seller's Web site. Stored in the file at the time of encryption, the URL points to the site of a publisher, author, retailer, or other Web address. If consumers try to open the file without a valid voucher, they are given the option to follow the URL to learn how to purchase the right to view the document. Publishers also use PDF Merchant to generate XML-encoded keys that specify the user's file permissions (ability to print, annotate, edit, or select text and graphics) and the environment in which the document can be used.

PDF Merchant technology allows publishers to adapt the terms or conditions of a sale to suit individual business needs. Publishers decide what is required to access the content and where to send users to purchase it. This system is designed to allow for many business models while giving publishers the tools and confidence to protect and sell their content electronically.

Retailers. Retailers might establish different consumer prices for different locking methods. For example, they might set one price for content on a network drive available to all users in a company, and another for content tied to a specific user. The retailer must also consider the methods for delivering access rights. A subscription system might download content automatically at predetermined time intervals. A lending plan might make content accessible for only a specific period of time. Once pricing and delivery issues are sorted out, established contracts with publishers must describe the business models and methods for revenue reporting.

Retailers might work directly with a publisher or an author to receive encrypted PDF files and keys for direct delivery to the consumer. There may also be an intermediate distributor who manages all related files—including the encrypted PDF files and keys—and delivers them either to the retailers or directly to the consumer. Distributors could manage archives, create backups, and process transactions. They would usually store backup transaction information in case a voucher or electronic document is lost. Furthermore, distributors could provide statistics to retailers such as the number of downloads, times of downloads, and pertinent consumer information. In the absence of a distributor, the retailer would be responsible for file management.

Retailers (or distributors) integrate PDF Merchant technology into their Web commerce systems in order to lock the PDF content to a specific user environment. This environment might be a single computer, perhaps all the computers in a classroom, or even an e-mail address. It could also be a portable media or temporary storage device. For example, several electronic files and their associated vouchers could reside on an Iomega Clik! disk. The owner could remove the disk (and the ability to use it) from his computer and share it with someone else in much the same way that a printed magazine or market research report is shared today. PDF Merchant provides additional capabilities, such as vouchers that become usable at a specific time or for a specific duration, and the ability to place watermarks directly onto the digital document.

For retailers, distribution via Adobe PDF Merchant not only streamlines inventory management, but also eliminates the costs of paper, ink, printing, and freight. Overall, the time it takes to produce content is sharply reduced, resulting in a dramatic improvement in time-to-market and the ability to deliver information almost as soon as it is authored.

Now any book, market research report, or financial analysis can remain available, tucked away in electronic storage, and easily retrieved. In addition, if consumers are anxious to purchase a best-selling book and they discover it has sold out, they might have the option to order a digital version immediately and receive the printed version when it becomes available.

Consumers. Purchasers of digital content can receive Adobe PDF documents in a variety of ways: over the Web, via e-mail, on CD, or on other removable media. When the consumer first opens the document, the Acrobat Reader with Web Buy checks for the voucher giving the user permission to view the document. If a valid voucher is found, Acrobat Reader opens the document. If a valid voucher is not found, the user is directed to a Web site to purchase a usage voucher. The voucher is keyed to one or more unique identifiers such as the CPU ID or a disk ID. The consumer can decide which identifiers they are willing to send to the seller. If the seller deems the information insufficient, they may decline to sell the license since it might not be uniquely tied to a specific computing environment.

Implemented as a plug-in, Web Buy will be distributed with every copy of the free Acrobat Reader in late 1999. As a plug-in, it will be easily updated as new features become available. Users won't need to go to a third-party's Web site to download software, nor will they have to worry about compatibility with future versions of Acrobat. Best of all, documents can be read on standard Windows® and Macintosh computers and notebooks, as well as dedicated reading devices that support Adobe PDF.

New business models

An extensible eCommerce system for digital documents opens up all kinds of possible applications and market opportunities. Here are just a few:

• *College textbooks*—Our rapidly expanding knowledge base means that yesterday's textbooks are out of date today. Add a long production cycle and the situation gets even worse. Digital content distribution would allow students to get the most up-to-date information and easily update course materials as they become available. Custom course materials could be developed with chapters from various books, along with backup articles and information from a variety of sources. Imagine getting rid of those 10-pound organic chemistry and physics books and having everything available in an electronic, fully searchable format that can be read on existing computers.

• *Marketing*—Always looking to gain valuable feedback and establish direct ties to customers, marketing professionals could give away newsletters, market research reports, or investment advice in exchange for a survey response or even an e-mail address.

• *Self-publishers*—While many self-publishers are selling content over the Web today, they have little control over how their content is used or how many people actually pay for it. By publishing in Adobe PDF and protecting their valuable content with PDF Merchant, new authors have a secure channel through which to sell their content. Most self-publishers will align themselves with Web-based retailers who can provide the Web presence and back-end commerce transaction to reliably fulfill consumer needs.

• *Sneak preview*—Most readers like being able to open a physical book, read the front and back covers, and peruse the Table of Contents before deciding to purchase it. Online book retailers could assemble introductory components of new books to deliver to potential buyers to capture their business. With this try-before-you-buy model, readers could be allowed to view the document for a limited-time sneak preview before their license expired. Likewise, a consumer might be immediately given an eBook enabled for one week when they also purchase a printed book on the Internet.

Technology details

Following is a short technical overview of the specific features and functionality of Adobe PDF Merchant and Acrobat with Web Buy, given to provide an understanding of how the technology can be used.

Document: The PDF file that contains the content being distributed.

Document locking: When a document is encrypted using PDF Merchant, it is said to be locked. The required input variables to this locking process are the PDF file, seller URL, seller ID, document ID, and the permissions granted for the file. The result is a locked PDF file and a PDF title key. The locked PDF file is encrypted with 56-bit encryption, and the encryption dictionary is signed with a 1,024-bit digital signature.

PDF title key: As part of the locking process, PDF Merchant generates a title key that uniquely identifies the content and is required to unlock the document later. The keys need to be available to the seller's Web site(s). Vouchers that contain that document's key are created for each unique buyer, and the content is locked to a specific computing environment.

Seller URL, seller name: When a document is locked with PDF Merchant, a seller name and URL are encoded in the document. When users without vouchers try to access a locked document, they are directed to the seller's Web site, where they can obtain the rights to access the document.

Document ID, seller ID: Adobe is responsible for ensuring all sellers have a unique ID called the seller ID. During the locking process, the publisher or retailer is responsible for defining a unique identifier for every document called the document ID. Thus, every document can be uniquely identified by the combination of its seller ID and document ID. There are evolving standards like Digital Object Identifiers (DOI) that could be used for document IDs. For more information on DOI, see *http://www.doi.org*.

Voucher: When a consumer requests the right to use a document, a voucher is generated by the retailer using PDF Merchant, which grants the right to the consumer. The document can then be opened in the specified environment. This voucher is stored in the same directory or path as the document on the consumer's viewing device and is accessed every time a locked document is opened. A copy of the voucher is also stored on the user's machine.

Once the voucher is available on the user's system, the user is not required to download it again. The voucher enables the user to open this file repeatedly (subject to the terms specified in the environment, which may give physical hardware or time constraints). The voucher is a digitally signed file that contains the document ID, permissions, and the environment expression or requirements.

Vouchers are signed XML 1.0 files. For those interested in the details, IETF (Internet Engineering Task Force) RFC 2396: Uniform Resource Identifiers (URIs) may be used to identify sellers. RFC 1113 Printable Encoding is used to communicate signatures. ISO 8601 time format is used for expirations (no Y2K problems). The ISO 639 standard (Internet RFC 1766) for language is used to identify to seller Web sites what language the buyer is using (English, Spanish, Japanese, etc.). The vouchers are signed with certified X.509 certificates.

Environment: The seller determines what set of computing environment variables are to be requested from the buyer, who then has the option of sending all, none, or some portion of those variables. If the seller does not deem the returned variables sufficient to lock the document to the buyer's computing environment, the reseller can decline to sell the content to the buyer.

The publisher or retailer has many choices available when choosing appropriate identifiers, enabling them to obtain the security level they require. The set of identifiers that content can be tied to include:

· *CPU Identifier*—A number that is derived from several data items that are unique to a given computer.
· *Fixed disk ID*—Each disk drive attached to a computer presents a unique ID from which documents can be accessed. For some disks, it is the 32-bit partition serial number assigned when the disk is formatted. For other disks, it is the factory-written serial number string assigned by the disk manufacturer.
· *Network disk ID*—Each network-shared drive also presents a unique identifier. Tying content to a network drive allows broader access to the document but may require different licensing.
· *Removable disk ID* (currently implemented for floppy disks, CD-ROM, Iomega Zip, Clik!, and Jaz removable media)—These removable media present unique IDs that cannot be changed by a user. They are well suited for distribution of information in kiosks, where the documents can be tied to a specific disk and can move between users as physical media. In the future, as more removable media incorporate guaranteed unique IDs, flash memory cards and similar technology can be used.
· *Time*—The Greenwich mean time from the computer. This allows for the use of time checks and expirations. (At present, these time limits cannot be strongly enforced on open Windows or Macintosh computers since a computer's time and date can be reset by the user. Adobe expects that in the future, more and more computer platforms will include a time that cannot be reset.)
· *User Name*—The login name of the user on the computer.

Future environment variables might include a smart card, IP address, a fingerprint, public key cryptography, or a handwritten signature.

Environment expression: Arbitrary AND-OR expressions using the various identifiers describe the circumstances under which a particular license can open a document. Here are a few examples that illustrate some of the possibilities:
• ALLOW IF USER = John Doe AND Time is greater than 1-SEP-1999:00:00.
• ALLOW IF CPU-id = John's desktop machine OR CPU-id = John's Laptop
• ALLOW IF Removable disk-id = Clik! disk inserted into kiosk at time of purchase
• ALLOW IF CPU-id = Jane's desktop where out-of-stock book was ordered online on 1-SEP-1999 AND time is less than 16-SEP-1999. (This example would allow an online book to be delivered prior to the paper edition arriving.)

There is a great deal of flexibility in these expressions, which enable traditional as well as new and creative business models for the licensing of documents.

Adobe encourages the creation of expressions with at least two alternatives, so that if a buyer sells, loses, or breaks the hardware associated with one item, the other identifier(s) can still be used to open the document. In particular, it is often useful to create an expression that says to open the document either on a particular CPU or a specific storage device. This allows upgrades of either the CPU or the storage device without the buyer needing to get a new voucher for a different environment.

Permissions/security: Encoded in the locked document as well as the associated voucher are the list of permitted rights to manipulate the document. At present these permissions are enabled for the entire document only. The allowable permissions are:

- *Print*—The ability to print one or more pages.
- *Changing the document*—The ability to modify the document, including adding or deleting pages.
- *Selecting text and graphics*—The ability to select text or graphics on a page and copy them into other applications.
- *Adding and changing annotations and form fields*—The ability to use the various annotation tools (sticky notes, text) and mark-up tools (highlight, strikethrough, pencil) in Acrobat or to edit form fields.

A particular feature must be enabled in both the document and the voucher for it to be enabled for the consumer. One tactic for publishers is to allow all permissions in the PDF file while disallowing selected permissions in the voucher. They could later allow these permissions by simply issuing a new voucher instead of having to re-encrypt the PDF file. Adobe expects that the default for most documents in digital distribution will allow only the addition of annotations.

Acrobat encryption technology is licensed from the industry leader, RSA Laboratories. Adobe Acrobat has used RSA encryption technology since 1993. The encryption features implemented in PDF Merchant differ from Acrobat software's security features in the encryption method used (56-bit encryption, signed with a 1,024-bit digital signature). Web Buy encryption uses a voucher file tied to the user's environment instead of a user-typed password to allow opening the document. The other underlying mechanisms do not differ.

Watermark: The use of watermarks allows unique identifiers to be displayed on-screen or in print that uniquely identify the purchaser of the content. The publisher defines the position and style of watermark using Acrobat form fields on one or more of the pages in the document. As part of standard Acrobat functionality, these fields can be set to display on-screen only, print only, or both. When the voucher file is created, the text for the watermark field is specified in form fields and can include variables such as the transaction date and ID, user name, and the environment where the document is viewed or printed. By using watermarks, one could track illegal use of a document such as with screen captures.

Adobe PDF for eCommerce document delivery

The transition to eCommerce by authors, publishers, retailers, and others is streamlined by using Adobe PDF technology:

- Acrobat Reader, the free software used to view PDF files, allows application-independent communications, ensuring that documents are displayed correctly on the recipients' machines regardless of what platform they are using or what software they have installed.
- More than 100 million copies of Acrobat Reader have been downloaded to personal computers throughout the world, and more than 100,000 copies are downloaded from Adobe's Web site each day, providing a ready-made channel into which publishers can sell their digital content. Since most consumers already view Adobe PDF files, there is no learning curve or need to adapt to a new environment.
- Adobe PDF files are compact and self-contained. They include all needed text, raster images, vector graphics, and fonts. Each of these components are compressed—LZW/Flate compression for text and vector graphics, LZW or JPEG for raster images, and CCITT Group 4 compression for monochrome images.

- Adobe PDF is an excellent container for electronic content. It provides reliable delivery and formatting, as well as visual fidelity with the printed version, including scalable text and graphics. In addition, PDF files can be annotated and marked up like printed documents, and they can be viewed across multiple platforms. For these reasons and more, PDF has become a de facto standard for sharing digital documents.

Conclusion

Many of the obstacles to selling digital content in the past have now been overcome by the infrastructure of the Internet. Bandwidth and eCommerce barriers are rapidly being removed, and digital content libraries are being built. The last hurdles involve securing the content, developing the ability to deliver across mixed computing environments, and adapting to ever-changing business schemes. Adobe is helping to solve these problems by providing Adobe PDF Merchant and Adobe Acrobat with Web Buy, as well as by working with publishers, distributors, retailers, and media partners committed to building standard solutions. Providing a secure and standard environment for the electronic commerce of digital content opens up different distribution channels and new business models for publishers willing to take advantage of them.

Supporting eCommerce for digital content is another component of the robust range of customer-centric initiatives known as Adobe ePaper® Solutions. From the digital content found in electronic books to valuable corporate information stored in diverse formats and locations, Adobe PDF makes all kinds of traditionally paper-based information more accessible, portable, and valuable. With Adobe Acrobat software and related Acrobat technologies such as Adobe PDF Merchant and Web Buy, Adobe helps deliver powerful, effective Adobe ePaper Solutions to consumers and enterprises alike. For more information on how Adobe is working to make the eCommerce of digital content easy for publishers, authors, and resellers, as well as information on other Adobe ePaper Solutions, please visit our Web site at *www.adobe.com.*